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HEALTH HAZARD EVALUATION REPORT 72-7-10

HAZARD EVALUATION SERVICES BRANCH

DIVISION OF TECHNICAL SERVICES

Establishment: Willard Bronze Company  
Cincinnati, Ohio

Report Prepared By: Lee B. Larsen, Supervisory  
Industrial Hygienist  
Western Area Occupational  
Health Laboratory

Edward Shmunes, M.D.  
Medical Officer  
Medical Services Branch

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH  
CINCINNATI, OHIO 45202

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WILLARD BRONZE COMPANY  
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SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees regarding exposure to aluminum dust, wax smoke, oil mist, and carbon monoxide at the casting cleaning department of the Willard Bronze Company, 1253 Knowlton Street, Cincinnati, Ohio.

Airborne oil mist concentration levels measured on March 22, 1972 at a DeWalt cut-off saw located in the casting cleaning department ranged from 17.7 to 18.9 milligrams per cubic meter which are in excess of the established standard of 5 mg/M<sup>3</sup> (Federal Register, Part II, §1910.93, Table G-3) promulgated by the U.S. Department of Labor. Environmental air concentration levels for aluminum, an inert dust with a standard of 15 mg/M<sup>3</sup>, ranged from 1.1 to 20 mg/M<sup>3</sup>; for carbon monoxide, a standard of 50 ppm, ranged from 5-100 ppm.

Employee complaints expressed were mainly from an aesthetic frame of reference. Fumes were often unpleasant to smell and conditions were smoky. As far as symptoms of disease states, there were very few and related to dust symptoms of the nose, eyes and throat. There was no dermatitis or symptoms relative to any other system.

Recommendations in areas of concern in the casting cleaning department of the Willard Bronze Company have been suggested to

management to alleviate the oil mist hazard and other health hazards to the 34 affected employees.

The company has plans to reduce or eliminate exposure to aluminum dust and wax smoke by the installation of dust collection systems on the stationary grinders.

Copies of this Summary Determination, as well as the Full Report of the evaluation, are available from the Hazard Evaluation Services Branch, NIOSH, 550 Main Street, Cincinnati, Ohio 45202.

- a) Willard Bronze Company
- b) Authorized Representative of Employees
- c) U. S. Department of Labor - Region V

For purposes of informing "affected employees", the employer will promptly either (1) "post" the Summary Determination in a prominent place near where affected employees work for a period of 30 days or (2) provide a copy of the determination to each affected employee.

## I. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees of the Willard Bronze Company at 1253 Knowlton Street, Cincinnati, Ohio.

Willard Bronze Company can supply design, engineering and layout services; wood, metal and plastic patterns; sand, plaster, precision, and permanent mold castings; heat treating; spectrographic, x-ray, zygo inspection and hydro-pressure testing. They also offer complete metallurgical laboratory service; casting impregnation service; and are able to produce castings completely machined to finished drawing specifications.

The plant has operated at this site for approximately 60 years. Their major function is the manufacture of aluminum permanent mold castings. Only approximately 10% of the work currently is bronze castings. There are about 150 salaried people, 120 of which work in the work areas. They operate 2 shifts a day, the first from 7:00 a.m. to 3:30 p.m. and the second 3:30 p.m. to midnight.

The hazard evaluation request concerned the casting cleaning department. In this department, aluminum and bronze castings are sawed and ground to produce a smooth casting. Thirty-four people were employed in the casting cleaning department.

The description of hazards enumerated in the hazards evaluation request were: aluminum dust, cutting oils, wax smoke and carbon monoxide gas. The type of exposures included respiratory and skin contact with dust, gases and mist.

## II. BACKGROUND HAZARD INFORMATION

The Occupational Health standards as promulgated by the U. S. Department of Labor (Federal Register, Part II, §1910.93, Table G-3) applicable to substances of this evaluation are as follows:

Nuisance or Inert Dust:

Respirable fraction	....	5.0 mg/M <sup>3</sup> *
Total dust	....	15.0 mg/M <sup>3</sup>
Oil mist, particulate	....	5.0 mg/M <sup>3</sup>
Carbon Monoxide 50 ppm*	....	55.0 mg/M <sup>3</sup>

Parafin wax fume - no standard has yet been promulgated for parafin wax fume. However, the American Conference of Governmental Industrial Hygienists has proposed a threshold limit value of 1 mg/M<sup>3</sup>.

\* Units of measurements are:

mg/M - milligrams of particulate per cubic meter of air  
ppm - parts of gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure.

### III. HEALTH HAZARD EVALUATION

#### A. Observational Survey

A hazard evaluation survey of the Willard Bronze Company at 1253 Knowlton Street, Cincinnati, Ohio was made on March 22, 1972 by the National Institute for Occupational Safety and Health representatives, Lee B. Larsen and Edward Shmunes, M.D. The function of the National Institute for Occupational Safety and Health and its relation to Section 20(a)(6) of the Occupational Safety and Health Act of 1970 and the purpose of the visit, was explained to Mr. , plant superintendent and to , Vice President. The National Surveillance Network Part I questionnaire was completed with the assistance of

and , employee representative, then accompanied us on a preliminary survey of the casting cleaning area.

The preliminary survey aided us in determining potential health hazards, any reported health effects on employees, and also to determine what type of sampling equipment would be necessary to evaluate exposures to potentially toxic materials.

The potential health hazards noted for various areas are described in the following paragraphs--medical findings are reported in another section of this report.

#### Aluminum Dust

Aluminum and bronze castings are ground to remove the rough surface from the castings. Five double end grinders are used. About 90% of the work involves aluminum castings. No health standard has been recommended for metallic aluminum dust. Therefore, the aluminum dust was evaluated as a nuisance type dust.

Aluminum is generally considered an innocuous metal as far as health hazards are concerned. Potential illness by ingestion is negligible, and the hazard by inhalation is generally considered low.

About 10% of the casting cleaning involves work with bronze. (Bronze-about 85% copper, 5% lead, 5% tin, and 5% zinc). These materials are considered more toxic than aluminum, especially where they are present as the metal fume. No bronze grinding was being done during the survey.

The aluminum castings are made in a grey iron permanent mold. No sand is used in these molds. Therefore, there is not a potential exposure to free silica. The bronze castings are made in a sand mold. There is a potential exposure to free silica during grinding on bronze castings from the small amount of sand remaining on the castings.

The Willard Bronze Company is having dust collection systems made for the stationary grinders. Effective exhaust ventilated dust collection systems should provide protection from all of the materials produced during grinding of bronze and aluminum castings.

#### Parafin Wax Fume

Two waxes are used in the cleaning area. A product called Taurax #250 sold by Texaco is used on three band saws. The Texaco product was reported by a sales representative for the Texaco Company in Cincinnati, to be a solid grease in sodium soap base. A worker indicated the Texaco product was not a problem as far as the production of "wax smoke" as a hazard.

Another type of wax is also used in the cleaning department. It is a parafin wax type product called Factowax R grid 133. This wax is applied to the grinding wheels. When large castings are ground, considerable "wax fume or smoke" is produced. There is no U.S. Department of Labor Standard at the present time for parafin wax fume. However, the American Conference of Governmental Industrial Hygienists has proposed a threshold limit value of 1 mg/M<sup>3</sup> for wax fume. The air contaminant produced because of the use of wax on the grinding wheels may be a wax fume or a decomposition product of the wax, or a combination of both. In any event, the proposed dust collection systems should aid in the control of the wax fume or "smoke" produced during grinding.



### Carbon Monoxide

Carbon monoxide from the indoor operation of internal combustion engines can be a serious health hazard. The carbon monoxide results from the incomplete combustion of the fuel used (gasoline, propane, butane, etc.).

It is generally accepted that a liquified petroleum gas (LPG) engine in good adjustment will produce less carbon monoxide than a gasoline engine in good adjustment. However, according to a statement from the publication entitled "Michigan's Occupational Health", field measurements of carbon monoxide in the exhaust of industrial lift trucks in a normal state of repair such as found in the majority of industrial establishments, fail to substantiate that the propane engine will continue to produce less carbon monoxide than its gasoline fueled counterpart. In fact, measurements have shown some propane engines to generate even more carbon monoxide than a comparable gasoline engine as the engines become less efficient due to needed service.

This publication also states: "Properly serviced engines in good condition can maintain, under constant load, carbon monoxide discharge levels at the exhaust pipe of less than 100 ppm when burning LPG." Conventional gasoline burning engines with standard carburetors usually discharge CO concentrations of 3-5 percent (30,000-50,000 ppm). Low emission engines will release 1-1.5 percent (10,000-15,000 ppm), depending on load and throttle position.

In order to prevent carbon monoxide levels from exceeding the Maximum Allowable Concentration of 50 ppm in a worker's breathing zone, adequate ventilation is required for all internal combustion engines operating indoors.

In the past this division (Michigan Department of Public Health) has recommended a ventilation rate of 5,000 cubic feet of air per minute (cfm) per operating vehicle. With the introduction of the new Maximum Allowable Concentration for carbon monoxide, this ventilation rate will have to be increased. At the present time it appears that the recommended figure will be about 10,000 cfm."

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Several methods have been proposed to eliminate the carbon monoxide health hazard associated with the use of fork lift trucks. The most common are: (1) battery powered trucks; (2) ventilation to reduce the concentration



of exhaust gases; (3) liquified petroleum gas (LPG); and (4) exhaust "purifying" devices. Battery powered lift trucks, and dilution ventilation are the most effective methods of controlling exposure to carbon monoxide.

One LPG lift truck has been used since November at the Willard Bronze Company. Three gasoline fueled fork lift trucks are used.

Carbon monoxide may produce death by asphyxiation in severe exposures to high concentrations of carbon monoxide. Exposures to carbon monoxide at lower concentrations may produce symptoms such as mild frontal headaches, generalized weakness, fatigue, and drowsiness.

#### Oil Mist

An oil-water mixture (1 part oil, 3 parts water) is used on two DeWalt cutoff saws. A fine oil-water mist is sprayed from a distance of about three feet onto the cutting surface. Not only is the area where the saw is used contaminated with the oil-water mist, but adjoining areas are also contaminated.

The chief problem which usually results from exposure to cutting fluids is contact dermatitis caused by the oils themselves or certain additives in them. Suspended particles or shavings in the cutting fluids may have an abrasive action on the skin, causing cuts or scratches. Harmful bacteria could then enter the tissues and result in infections.

Prolonged exposure to inhalation of oil mists may cause mucous membrane irritation. If the concentrations of the mist is very heavy, lipoid pneumonitis could develop from inhalation and subsequent contact with lung tissue.

#### B. Environmental Survey

The follow-up health hazard survey was conducted on March 22, 1972 the same day as the preliminary survey. One personal and one general room (area) sample was collected to evaluate exposure to oil mist. One area and four personal samples were collected to evaluate exposure to aluminum dust and "parafin wax fume."

Samples were collected on vinyl metrical filters which permitted a weight determination. After weighing, the samples were submitted to the laboratory for determination of oil or aluminum. A fluorescence analyses of samples collected for oil mist indicated that the weight gain on vinyl metrical filters was due to oil.

Carbon monoxide measurements were made with Drager indicator tubes. A "wax fume" estimation was made by subtracting the aluminum present on the filters from the total weight gain. Any weight gain would be due to the aluminum present, wax fume, wax decomposition products, and any dust produced from the grinding wheel. Thus the determination of wax fume was only a rough estimate of the wax fume present at the time of sampling.

Grinding on large castings was done for a very short period of time on the day of the survey. For this reason, samples were not collected for a weight determination during grinding on large castings. It was observed that copious amounts of air contaminants were produced during grinding on large castings and the need for better control procedures seemed apparent.

#### Results:

Samples were analyzed by the Western Area Occupational Health Laboratory, Division of Laboratory and Criteria Development, NIOSH. Results are shown in Table 1.

##### 1. Aluminum dust

The nuisance dust standard was exceeded for aluminum dust during the sampling period in one location.

##### 2. Wax fume

Rough estimates of the "wax fume" produced at four different grinding locations varied from 0.2 mg/M<sup>3</sup> to 1.9 mg/M<sup>3</sup> of non-aluminum material. Much higher concentrations of wax fume or smoke are probably generated during grinding on large castings.

##### 3. Oil mist

The U.S. Department of Labor Standard for oil mist was exceeded at the DeWalt cut-off saw located in the center of the building. The other DeWalt cut-off saw was not in use during the survey.

#### 4. Carbon monoxide

Carbon monoxide concentrations did not generally exceed the U.S. Department of Labor Standard for carbon monoxide during the sampling period though one determination was 100 parts per million for a short period of time measured during vehicle operation.

Carbon monoxide concentrations will probably vary from day to day, and from one season to another depending upon operating and control procedures. It is the company's responsibility to maintain carbon monoxide concentrations at or below recommended safe levels. The worker has the responsibility of turning off carbon monoxide producing equipment when it is not being used, and not permitting engines to idle for long periods of time at any location inside buildings.

#### C. Medical Evaluation

Twenty workers were assigned to the first shift, 18 of whom were present on the day of the survey. All 18 of these gentlemen were interviewed to solicit the kinds of symptoms they may have had since their employment. Only two employees had been referred to the company physician during their employment, both of these for physical injuries. Historically, complaints from the 18 workers interviewed concerned mainly dust which they alleged was a nuisance. They commented they didn't like the smoky conditions but in actuality only four of the 18 actually expressed symptoms of eye, nose, and throat irritation. There was no history of any increased incidence of pneumonia or serious lung disease. One worker wore a respirator because he felt the cutting oil mist from the machine made him wheeze. This individual was an asthmatic prior to his employment and wheezing can be triggered by any dusty situation either in plant or out. He does not have a problem when he wears his respirator.

There were no signs of dermatitis, or upper respiratory tract, eye or nose inflammation on the day of the visit.

During the walk through visit it was obvious that when the machines were working there was a considerable amount of smoke and/or mist around the grinding and sawing machines. None of the 18 who were interviewed complained of dizziness, headache or other symptomology relative to carbon monoxide.

In summary from the medical standpoint the complaints expressed were mainly from an aesthetic frame of references. Fumes were often unpleasant to smell and conditions were smoky. As far as symptoms of disease states, there were

very few and related dust symptoms of the nose, eyes and throat. There was no dermatitis or symptoms relative to any other system.

Environmental sampling revealed an oil mist concentration in the range of three times the threshold limit value for oil mist. This particular standard has been quoted to contain a factor of safety of at least 10-fold against even relatively minor changes in the lungs and the threshold limit value has been established as an index of good industrial practice rather than physical hazard. In this light the ventilatory improvements recommended as part of this report will take care of the problem of oil mist in this plant.

#### IV. RECOMMENDATIONS

1. Provide an exhaust ventilated dust collection system for all stationary grinders.

A U. S. Department of Labor regulation (§1910.94) states that "every establishment performing dry grinding, dry polishing, or buffing shall provide suitable hood or enclosures that are connected to exhaust systems. Such exhaust systems shall be operated continuously whenever such operations are carried on, and be capable of preventing contaminants from entering the breathing zone."

2. The above control procedures should provide adequate control of "wax fume" as well as other contaminants. Existing exposure levels of wax fume at the Willard Bronze Company were not extensively investigated during this survey. It was stated during the survey that the company plans to install dust collection systems for stationary grinders. Based on this information, it was decided by the authors of this report to issue the report without returning to the plant to conduct additional sampling for wax fume at the present time. It is assumed the contemplated dust collection systems when installed will control exposure to wax fume. If after installation of the dust collection systems the company or the union has any question concerning the effectiveness of the systems for controlling the "wax fume" contaminant or other contaminants, a request should be made for an evaluation of the air contaminants of concern.

3. Use dilution ventilation to keep carbon monoxide concentrations at safe levels at all times.

4. Reduce oil mist concentrations at the DeWalt saws to safe levels by modification of the existing method of applying oil lubricant or by provision of exhaust ventilation or both.
5. Institute and maintain good housekeeping procedures throughout the plant.
6. Individuals with history of bronchitis, asthma, chronic sinus, nasal allergies, chronic conjunctivitis, as well as lung diseases in general, should be assigned to jobs in the relatively non-dusty areas of the plant when possible.